STABILITY OF MORPHOLOGICAL CHARACTERS OF BRYOPHYTES UNDER CULTIVATION: A COMPILATION FROM THE LITERATURE.

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Because different taxa of bryophytes respond in different ways to similar environmental conditions, the literature is rife with conflicting reports of the relative stability of certain morphological characters. Are any of these characters universally stable under a variety of environmental conditions? Can any be used for reliable and repeatable diagnoses of differences between taxa?

Cultivation of bryophytes can identify which characters of particular species remain stable under different environmental conditions. The contributions and methods of numerous investigators using axenic and non-axenic "common garden" cultivation have been reviewed recently (Smith 1978; Longton 1982; Zander 1982; Wyatt and Stoneburner 1984; Frahm and Nordhorn-Richter 1984; Mishler 1985). Although the literature for axenic culture of bryophytes is large, not many investigators have experimented with common garden propagation (Shaw 1986).

Table 1 summarizes reports on the stability of characters of bryophytes under cultivation. It also shows the frequency with which particular characters have been used by investigators. It is clear that although some characters are stable for some taxa, they are unstable in the majority of cases. Only twelve characters (marked with asterisks) have been reported to be stable, and lack reports to the contrary. Ten of these characters are based on a single report involving only one genus or one species complex within one genus. There is no basis for comparison with results from other studies, because the taxa, characters and methods of cultivation are too diverse to form any general conclusions.

Some of the variability reported by Meyer (1940, 1942) was based upon mosses grown under conditions radically different from those usually encountered in nature by the subject taxa. Non-aquatic species of Atrichum, Barbula, Hypnum, Phascum, Physcomitrium and Polytrichum were grown submerged in liquid culture media. These experiments, and observations from nature (e.g., Priddle 1979; Seppelt and Selkirk 1983) indicate that few characters of bryophytes are stable.

We must carefully compare cultivation methods and growth response in a wide array of bryophyte taxa before we can

formulate a list of universally stable characters, if any exist at all. Of the twelve characters herein reported to be stable, those that lack reports to the contrary are good candidates for further study.

Table 1 - Relative stability of morphological characters in cultivated bryophytes, as reported in literature.

Character	Sources in Literature	
	Stable	Unstable
* alar cells	11,14	-
awn base	-	28
awn color	-	28
awn length	-	28
awn serration	-	28
* branching pattern	27	-
bulbil morphology	20	20
costa anatomy	28	18
costa color	-	28
costa length	14,28	2,4,8,9,13,27
* costa papillae	28	-
* costa serration	28	-
costa width	16	11
gametophyte morphology	-	19
guide cells	-	13
leaf and bract apex	18,25,27	8,9,18,23,28,29
* leaf auricles	11	-
leaf cell length	30	11,15,18,22,28
leaf cell shape	16,18	7,8,9
leaf cell size	-	6,28
leaf cell wall pitting	-	13
leaf cell wall thickness	-	5,8,9,13,18
leaf cell width	-	15,18,21,22,28
leaf chloroplast number	-	8,18
leaf chloroplast size	-	8,18
leaf color	-	1,8,11,28
leaf concavity	-	28
leaf decurrency	16,26	17
leaf dentition	14,16,19	4,6,8,9,10,13,26
* leaf insertion angle	28,30	-
leaf lamellae	-	13
leaf length	-	11,13,21,22,27,28
leaf margin rolling	-	18,28
* leaf papilla number	18	-
* leaf papilla position	18	-
* leaf papilla shape	28	-
leaf papilla size	-	18

leaf plication	-	18
leaf shape	18,19,28	1,8,9,11,13,14,18
leaf and underleaf size	-	1,2,6,7,8,9,11,14 15,18,22
leaf spacing	-	5,7,8,9,18,28
leaf undulation	-	13
leaf width	-	8,21,22,28
oil bodies	22,26	18
phyllotaxy	-	18
plant size	-	13
propagula production	-	18,23,26
* protonemal morphology	27	-
pseudostereids	-	24
rhizoid abundance	-	18
* seta papillae	19	-
* sporophyte morphology	19	-
stem anatomy	28	8
stem diameter	-	8,9,22
stem length	-	4,5,18,27,28

References: (1) Bastit 1891, (2) Servettaz 1913, (3) Gurlitt 1918, (4) Maheu 1922, (5) Douin 1925, (6) Davy de Virville 1927, (7) Leach 1930, (8) Meyer 1940, (9) Meyer 1942, (10) Agnew 1958, (11) Lodge 1960, (12) Forman 1964, (13) Briggs 1965, (14) Sonessen 1966, (15) Hatcher 1967, (16) Koponen 1967, (17) Wigh 1972, (18) Zales 1973, (19) Wigh 1975, (20) Lewis & Smith 1977, (21) Steel 1978, (22) Guerke 1978, (23) Zander & Hoe 1979, (24) Florschutz-de-Waard & Worrell-Schets 1980, (25) Zander & Eckel 1980, (26) Zehr 1980, (27) Longton 1981, (28) Mishler 1985 (29) Field 1987, (30) Christy 1987.

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